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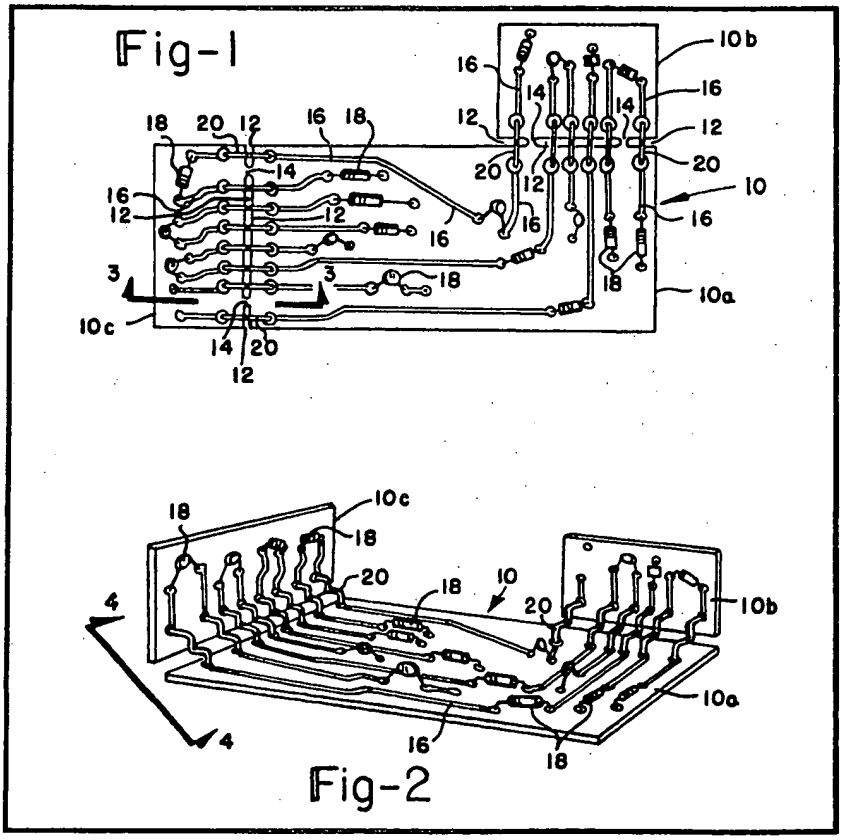
(54) Interconnecting conductive paths between a main circuit board and ajacent circuit boards

(57) A single circuit board 10 is provided with aligned spaced openings 12 which have ends of circuit paths located on each side of the openings. Electrical components 18 are loaded into the board which are interconnected by the circuit paths and electrical connectors 20 are inserted into the ends of the circuit paths across the openings. The components and connectors are soldered in position and the board is tested. Areas between the spaced openings are removed to form two or more separate circuit boards 10a, 10b, 10c. The electrical connectors are bent so that one circuit board is positioned at an angle with respect to the other board.



The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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Fig-1

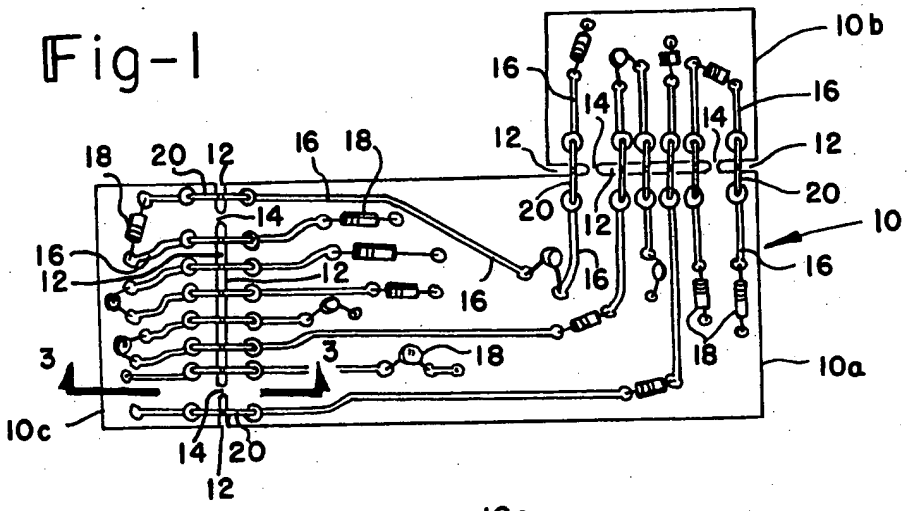


Fig-2

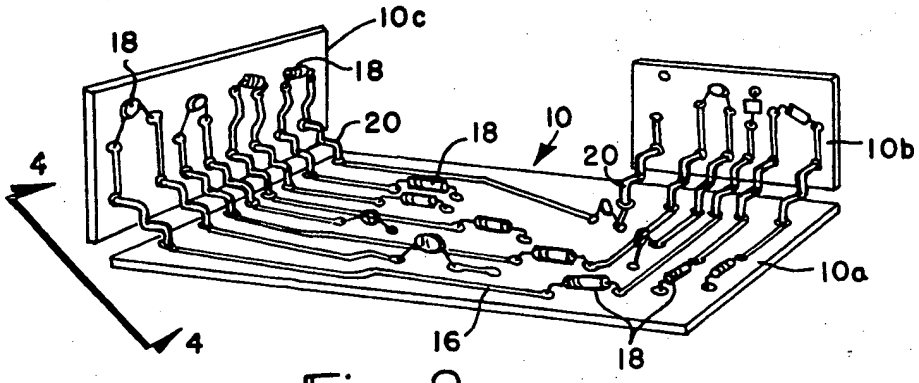


Fig-3

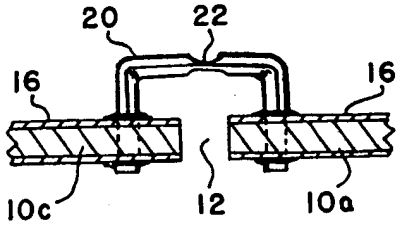
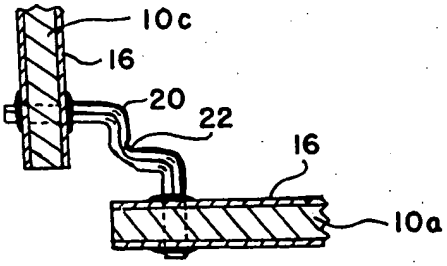


Fig-4



SPECIFICATION

Method and apparatus of interconnecting conductive paths between a main circuit board and adjacent circuit boards

Background of the Invention

The present invention relates to a method and apparatus of interconnecting conductive paths and more particularly to a method and apparatus of interconnecting conductive paths between a main circuit board and adjacent circuit boards.

Various schemes have been utilized to interconnect conductive paths of adjacent circuit boards when the boards are disposed parallel to each other, in the same plane or at an angle with respect to one another. These interconnection schemes are disclosed in U. S. Patent Nos. 2,740,097; 3,184,645; 3,362,005; 3,772,776; 4,109,299 and French Patent No. 1,239,226.

These schemes are directed to particular concepts of making interconnections between conductive paths of adjacent circuit boards after the boards have had components added thereto, they have been soldered in place and then tested. This is normal practice, however it takes time and expense to treat each circuit board separately, and, after they have been interconnected, tests will be conducted to make certain the circuits on the boards have been properly interconnected as required.

Summary of the Invention

A large circuit board is formed which is divided into a main circuit board and at least one secondary circuit board. Oblong openings separate the main circuit board from the secondary circuit board and the boards are provided with small areas between the oblong openings to maintain the boards together for purposes of installing electrical and electronic components therein, inserting electrical connectors across the oblong openings where the ends of circuit paths of each board are located to interconnect these circuit paths, flow soldering the components and connectors in position, testing the boards, removing the areas between the oblong openings, and bending the electrical connectors so that the secondary board is disposed at an angle with respect to the main board.

A primary object of the present invention is to form a large circuit board into a main circuit board and at least one secondary circuit board, interconnect the circuit paths therebetween, by aligned connectors, flow solder the components and connectors and test the board.

Another object of the present invention is the provision of applying electrical connectors to the ends of the circuit paths of a circuit board which have electrical components therein, soldering the components and connectors to the board, testing the board and separating the board into separate circuit boards along the connectors.

A further object of the present invention is to provide a circuit interconnecting ends of circuit paths across openings in the board, soldering the components and connectors to the board, testing the board, removing areas of the board between the openings to separate the board into separate circuit boards interconnected by the connectors and bending the electrical connectors to position the separate boards at an angle with respect to on another.

An additional object of the present invention is the provision of a circuit board having circuit paths thereon for interconnecting electrical components, aligned openings located in the board which are separated by areas, ends of circuit paths disposed on each side of the openings for receiving electrical connectors to interconnect the circuit paths, the areas between the aligned openings are removable to separate the board into separate circuit boards and the separate boards can be disposed at an angle with respect to one by bending the connectors.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention as illustrated in the accompanying drawing.

Brief Description of the Drawing

Figure 1 is a top plan view of a circuit board soldered in position;

Figure 2 is a perspective view of the board of Fig. 1 illustrating the board being separated into separate circuit boards disposed at an angle with respect to one another;

Figure 3 is a cross-sectional view taken along lines 3–3 of Fig. 1; and

Figure 4 is a cross-sectional view taken along the lines 4–4 of Fig. 2.

Detailed Description of the Invention

Turning now to the drawings, a main printed or etched circuit board 10 is formed of a suitable insulating material and it has aligned ablong openings 12 formed therein and they are separated by areas 14. In this way, board 10 is separated into a main board 10a and secondary boards 10b and circuit paths 16 of conductive material are provided on board 10 and ends of some of the circuit paths surround holes extending through boards 10a, 10b and 10c in which leads of electrical components 18 are inserted. Circuit board 10 can have conductive paths on the top and bottom surfaces thereof or it can be a conventional multilayer circuit board as desired. The conductive paths interconnect the electrical components to form electronic circuits on each of boards 10a, 10b and 10c.

Some ends of circuit paths 16 terminate adjacent oblong openings 12 in an aligned row on each side of the openings and thereacross and these ends surround connector-receiving holes that extend through boards 10a, 10b and 10c. Ends of staple-shaped or U-shaped electrical connectors 20 are positioned in respective aligned holes across openings 12 to interconnect circuit paths between boards 10a, 10b and 10c. In this way, electronic circuits on each board 10a, 10b and 10c are interconnected. The bights of electrical connectors 20 are crimped thereby deformed to form bending sections 22. The connectors are formed and inserted in the aligned holes in the ends of the circuit paths by a machine that cuts a continuously-fed tin-coated copper wire to a desired length, the cut wire is formed into a U-shape and the bight is crimped, then the U-shaped connector is inserted into respective aligned holes.

In practice, board 10 is loaded with electrical components and these components and circuit paths form electronic circuits on boards 10a, 10b and 10c and electrical connectors are inserted into the aligned holes across openings 12 to interconnect the circuits. The leads of the components and ends of the connectors can be inserted into the board holes manually, by operator-controlled machines or by computer-controlled machines.

After insertion of the components and connectors into board 10, it is then soldered by conventional soldering techniques such as, for example, flow soldering. The board is then tested by conventional board-testing equipment, and, when testing has been completed, areas 14 are removed by cutting or the like. Boards 10b and 10c are then disposed at an angle with respect to board 10a by bending connectors 20 about bending sections 22. Thus, electrical connectors 20 act as hinge means as well as mechanical support means to support the boards relative to one another. Boards 10b and 10c can be disposed at any angular disposition to accommodate any configuration. Thus, the completed board 10, with boards 10b and 10c disposed at right angles with respect to board 10a, can constitute the complete circuit arrangement for an electronic instrument and this board can be positioned in an electronic cabinet which will be an electronic instrument such as an oscilloscope, counter DMM, etc.

The present invention therefore enables a single circuit board to be loaded with components to be interconnected by circuit paths to form electronic circuits and electrical connectors to be inserted into the board in aligned rows to interconnect the circuit paths. The board is then, subj cted to a s ld ring op ration to s ld r th components and connectors in position whereaft r it is test d. Areas of the board are removed adjac nt th conn ct rs so that the board is formed into a main circuit board and secondary circuit boards and the connectors are bent to positi n th secondary boards at an angle with respect to th main board.

While this invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

CLAIMS

1. A circuit board comprising a planar member of insulating material having spaced conductive circuit paths secured to at least one surface thereof, aligned openings provided in said planar member separated by areas to separate said member into a main section and a secondary section, and ends of some of said circuit paths disposed in alignment on each side of said openings for receiving electrical connectors therein to interconnect the circuit paths between the main section and secondary section, said areas upon being removed enabling said secondary section to be disposed at an angle with respect to said main section by bending said electrical connectors.

2. A circuit board according to claim 1 wherein said openings are oblong.

3. A method of making two circuit boards from one circuit board, comprising the steps of:

loading the circuit board with electrical components thereby forming electronic circuits connected together by circuit paths on the circuit board;

inserting electrical connectors into aligned ends of circuit paths disposed on each side of spaced openings in said circuit board with the electrical connectors extending across said openings to interconnect;

soldering the components and electrical connectors to their respective circuit paths;

testing the circuit board;

removing areas between said spaced openings to separate the circuit board into two circuit boards.

4. A method according to claim 3 which includes the further step of bending said electrical connectors thereby positioning one circuit board at an angle with respect to the other circuit board.

5. A circuit board substantially as hereinbefore described, with reference to and as illustrated in the accompanying drawings.

6. A method of making two circuit boards from one circuit board substantially as hereinbefore described.

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